

High Performance Computing (HPC) Application Performance Prediction & Profiling Tools

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The official link for this solicitation is:

<http://www.acq.osd.mil/osbp/sbir/solicitations/sbir20152/index.shtml>

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Topic Number:

DTRA152-003

Description:

DTRA uses High Fidelity computer codes to investigate weapon effects phenomenology and techniques for countering WMD. End to end High Fidelity simulations in support of the DTRA Agent Defeat Warfighter Capability will require calculations including multiple phenomena that occur in vastly different time scales (μ s to hours). The resulting code run times will be prohibitively long without optimization for next generation computer architectures. PHASE I: Develop an approach for design or modification of existing code profiling tools that are capable of handling High Fidelity codes as described above. Identify key concepts and methods that, when implemented, will provide non-intrusive tools that are effectively operable on complex High Fidelity applications codes. State of the art, innovative application code profiling tools as envisioned here, will need to enable performance and energy use prediction on a cross platform basis, i.e., Run on one architecture to predict performance on a future or different architecture. The tools must operate on optimized executables, not source code, and produce readily understandable results. PHASE II: Develop a production ready suite of profiling tools based on the Phase I approach. Demonstrate the use of the tools on DTRA in-house and DOD HPCMP systems on a broad range of High Fidelity application codes to include both rectangular grid and unstructured, three-dimensional adaptive mesh, coupled Computational Fluid Dynamics (CFD) / Computational Structural Mechanics (CSM) codes, explicit finite element codes used for short strong shocks, and chemistry codes used in conjunction with CFD codes PHASE III: The

code profiling tools developed for use on very demanding application codes will be well suited, once refined, for use on more general HPC workloads. Improvements in this phase are expected to involve ease of use enhancements and hardening of the profiling tools for use on a wide range of application software used in Government research and industry.